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Number 1

Aquaculture

An Overview

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Agricultural Issues Overview Number 1

December 1981

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Focus on the Issue

Definition and Background

For centuries, people have explored the possibility of propagating and rearing aquatic animals and plants in a controlled environment. Known as "aquaculture," this process of fish production was first attempted in China as early as 2000 B.C. By 200 B.C., fish were being raised in commercial quantities for the first time in history. Since then, however, farm-produced fish have remained a relatively minor proportion of the world's food supply. Only recently has large-scale aquaculture become both necessary and feasible.

To meet international food needs, worldwide aquaculture doubled during the 1970s and now accounts for 10 percent of the world's seafood production. Countries such as China, Japan and the Soviet Union have been expanding aquaculture activities rapidly. Including the production of both fresh and salt water fish, aquaculture accounts for over 40 percent of the total fish supply in some countries, compared to only 8 percent in the United States.

Potential for Aquaculture

Expansion of U.S. aquacultural activities affords many advantages to consumers and producers of aquaculture products. First of all, fish provide a nutritious addition to the American diet. Fish or fish products are an all-purpose protein food, containing amino acids, minerals, and water soluble vitamins essential to human health. Fish muscle, which contains no carbohydrates and little fat, is leaner than most meats.

Moreover, increased aquaculture could help reduce the U.S. trade deficit and, concurrently, help satisfy the world's growing need for animal protein. In 1977, the U.S. imported over 50 percent of its fish and shellfish, causing a balance of trade deficit of nearly \$2 billion. Raising fish specifically for export (e.g., eel for Japan and Europe where they are a delicacy) would favorably affect our national balance of payments.

Aquaculture also can provide additional stability and diversification for U.S. agriculture and agribusiness. The industry provides employment in fish farms, feed mills, processing plants and other supporting industries. Moreover, aquaculture gives farmers an alternate farm enterprise, thus maximizing the potential of income, land, labor and other resources. The industry can take the financial peaks and valleys out of many farming operations through an additional, and sometimes off-season, crop. Cold water fish like trout can be raised in catfish ponds in the winter; crawfish spawn and grow well in rice fields.

Finally, aquaculture can augment fish stocks for commercial and sport fisheries that have declined due to exploitation, pollution and habitat destruction.

Problems

In spite of the environmental and economic advantages associated with the expansion of aquaculture in the United States, aquaculturalists must overcome many obstacles. The industry requires space in unpolluted coastal or estuarine water, and plentiful supplies of high quality fresh water--resources that are in high demand. Institutional barriers such as zoning, waste control and licensing are still major problems, and the high risks associated with aquaculture make private investments scarce. Further, consumer concerns over the quality of fish is seen as an impediment. Catfish, for example, are known in some areas of the country as scavenger fish, less attractive and less flavorful than many fish such as trout or flounder. This problem may be overcome by demonstrating the nutritional, visual and taste-appeal nature of farm-raised catfish.

Federal Government Programs

In an attempt to overcome these obstacles, Congress passed the National Aquaculture Act of 1980 (P.L. 96-362), affirming the Federal Government's recognition of the importance of aquaculture and the need for effective programs to support it. The law states that it is the national policy of the United States to encourage the development of aquaculture. Recognizing that "the principal responsibility for the development...must rest with the private sector," Congress felt that the role of the Federal Government should be to provide encouragement through programs and services that cannot reasonably be expected from private sources. In that respect, Federal agencies are involved in a wide variety of activities. For example, the Small Business Administration can assist small business concerns which are engaged in aquaculture. The Department of Commerce, through its aquaculture research activities and Sea Grant program, supports marine research, development and advisory services. The Department of Interior maintains fish hatcheries, research and development laboratories, and cooperative fishery units. However, the bulk of aquaculture responsibilities lies within the Department of Agriculture. An internal Aquaculture Work Group has developed an annual department work plan and budget, and acts as a forum for the continual exchange of information. An Aquaculture Policy Committee provides department-wide policy coordination and implementation of aquaculture activities. In addition, research funded and coordinated by the department is under way at many universities and experiment stations. Topics being studied include the selection of species and combination thereof; feeding and harvesting; disease control; and the economics of the catfish-for-food industry.

Numerous interagency activities also have been mandated by the National Aquaculture Act. The law requires the preparation of a National Aquaculture Development Plan by the Departments of Agriculture, Interior and Commerce through the Joint

Subcommittee on Aquaculture (JSA) of the Federal Coordinating Council on Science, Engineering and Technology. Composed of the heads of the 13 Federal agencies with aquacultural responsibilities, the JSA was created in 1978 by Executive Order to increase the overall effectiveness and productivity of Federal aquaculture programs by allowing for increased planning, coordination and communication among these programs. A draft of Volume I of the Plan, which was released for public comment on October 2, 1981, describes the technologies, problems and opportunities associated with U.S. aquaculture. Moreover, this initial volume recommends actions to solve the problems and analyzes the social, environmental and economic impacts of growth in the aquaculture industry. Volume II (Species Plans) will be available for public review in late 1981.

In addition, the JSA has produced two reports examining capital requirements and State and Federal regulatory restrictions to development of the aquaculture industry. Both reports were released in October 1981. The JSA also has sponsored the English translation of relevant aquaculture literature from foreign languages.

From the Literature

This section of the Overview was compiled to provide readers with a representative sampling of the literature available on aquaculture. The materials presented here have been selected from the National Agricultural Library's computerized AGRICOLA (Agricultural On-Line Access) family of data bases. AGRICOLA consists of indexes to worldwide journal and monographic literature and U.S. Government reports on general agriculture, food and nutrition, agricultural economics, and many related scientific and sociological subject fields. Over 1,400,000 records are included in the file which covers literature published since 1970.

The reference staff of the National Agricultural Library (NAL) provides customized computer searching of AGRICOLA and other data bases available from commercial vendors, as well as copies of abstracted materials. For assistance, call (301) 344-3705.

Several other computerized data bases contain citations to aquaculture-related literature. Two of them, Aquaculture and ASFA (Aquatic Sciences and Fisheries Abstracts), are specifically concerned with the subject. Aquaculture, prepared by the Environmental Science Information Center of the U.S. National Oceanic and Atmospheric Administration (NOAA), is a small file (ca. 8,000 records) extending from 1970 to the present and covering U.S. and foreign books, periodicals, and conference proceedings. It contains information on the growing of marine, brackish-water, and fresh-water organisms. ASFA, prepared by the Food and Agriculture Organization and UNESCO, is a comprehensive data base (ca. 90,000 records) corresponding to the printed publication of the same name. The online file extends from 1978 to the present and contains materials on life sciences of the seas and inland waters as well as related legal, political, and social topics. NOAA responds to questions regarding the content of both Aquaculture and ASFA.

Aqualine, prepared in Buckingham, England, by the Water Research Centre, corresponds to the printed WRC Information and covers scientific and technical information on water, waste water, and the aquatic environment. It contains approximately 22,000 records, including foreign and domestic journals, books, conference proceedings, and government reports. Biosis, prepared by Biosciences Information Service, covers all of the life sciences. It includes within its scope limnology, or fresh water ecology, aquatic wildlife management, and fisheries biology. All the above-mentioned files are available through Lockheed Information Systems.

The following selection of recently published journal articles, monographs, and research reports focuses on the commercial production of freshwater fish for food. Topics discussed include breeding, growing, and harvesting techniques as well as the economics of production and marketing. Citations are arranged in reverse chronological order.

Selections are limited to materials in the English language; in fact, however, a substantial proportion of the relevant literature is in foreign languages, notably Japanese. The Joint Subcommittee on Aquaculture of the U.S. Government has undertaken to translate and make available some of the material. Translations and a list of available aquaculture translations may be obtained from NAL's Lending Branch (Beltsville, MD 20702).

EFFECT OF STOCK DENSITY ON GROWTH AND SURVIVAL OF RAINBOW TROUT (SALMO GAIRDNERI RICH)

Trzebiatowski R, Filipiak J, Jakubowski R. Aquaculture 22:3, Feb 1981, 289-95.

This study analyzes the effects of various stock densities on the growth and survival of rainbow trout in cages in power station cooling waters. Fish production and weight gain per cubic millimeter of water as well as feed conversion rate increased with stock density. On the other hand, individual growth and natural losses were inversely proportional to density. Fast flowing cooling water is apparently a favorable milieu for high-density trout culture.

THE RATIONALE AND RELEVANCE OF GENETICS IN AQUACULTURE: AN OVERVIEW

Wilkins ND. Aquaculture 22:3, Feb 1981, 209-28.

Aquatic organisms are still largely undomesticated, and little is yet known about many basic features of their genetic constitution; genetic improvement studies, therefore, have even wider implications in aquaculture than in agriculture. This overview outlines appropriate genetic studies for pre-cultivation, cultivation, and post-cultivation research activities, and relates these studies to other aspects of fisheries biology and fish husbandry.

PUSHING BACK THE FRONTIERS OF AQUACULTURE DEVELOPMENT: THE
SEAFDEC (SOUTHEAST ASIAN FISHERIES DEVELOPMENT CENTER) AQUA-
CULTURE DEPARTMENT

Aquaculture 7:2, Jan/Feb 1981, 18-22.

SEAFDEC was established to explore the potential for an aquaculture industry in Southeast Asia. Its Aquaculture Department, located in the central Philippines, has as its major functions research, training, and extension. It has been credited with a number of research breakthroughs, notably with prawn and milkfish, where successful spawning in captivity has been achieved. The Department engages in both salt-water and freshwater aquaculture. The identified research areas are meant to solve some industry problems such as: dearth of fish seed, cost of feed, diseases, distribution problems, financing low output, and engineering constraints. Another topic discussed in the article is mariculture, focusing on molluscs and seaweed.

WATER QUALITY AND FISH PERFORMANCE

Smart G. Fish Farming International, 7:4, Dec 1980, 16-17.

Changes in water quality can be economically damaging to the fish farmer. Fluctuations in dissolved oxygen, ammonia, carbon dioxide and certain other components can result in poor growth and food conversion efficiency. Factors such as temperature, salinity, pH, and water hardness must also be taken into account.

REVIEW OF CAGE CULTURE ACTIVITY INDICATES CONTINUING INTEREST
Newton SC. Aquaculture 7:1, Nov/Dec 1980, 32-36.

In recent years caged culture of catfish and trout has developed into a viable component of the fish farming industry. Major advantages of this system are ease of caring for, observing, and harvesting the fish. Low oxygen levels continue to be a major obstacle. In the future cages may assume a more basic role for household fish production.

SWEDEN DEVELOPS A CLOSED SYSTEM

Jernelov A, Kossman H, Martin J. Fish Farming International 7:4, Dec 1980, 7.

The Swedish Water and Air Pollution Research Unit (IVL) has patented a system which they feel solves the problems of water system treatment in a closed aquaculture system. Both the problems and their solutions are closely examined.

YIELD CHARACTERISTICS OF THE PRAWN (MACROBRACHIUM ROSENBERGII)
IN TEMPERATE ZONE AQUACULTURE

Brody T, Cohen D, Barnes A, Spector A. Aquaculture 21:4,
Dec 1980, 376-85.

Yields of freshwater prawn are examined in both commercial and experimental ponds during a pilot growth trial in Israel. It is concluded that combined stocking of larger animals, early selective harvesting, and reduction of density during the final growout, can prove useful in attaining commercial yields. (Journal abstract, adapted)

ESCAPEMENT GOALS FOR COHO SALMON IN COASTAL OREGON STREAMS
Beidler WM, Nickelson TE, McGie AM. Oregon Department of
Fish and Wildlife, Research and Development Section, Information Report Series, Fisheries Number 80-10, Nov 1980, 30.

This report recommends an escapement goal for coho salmon to Oregon coastal streams based on analysis of existing data sets. Four methods were used to estimate optimum escapement: stock recruitment, progeny-catch, smolt production, and the back calculation of number of spawners. An escapement goal of 200,000 adult coho salmon is recommended. It is suggested that specific goals be set for each river basin. (Journal abstract, adapted)

CRITICAL THERMAL MAXIMA OF FIVE TROUT SPECIES IN THE SOUTH-
WESTERN UNITED STATES

Lee RM, Rinne JN. Transactions of the American Fisheries Society 109:6, Nov 1980, 632-35.

Critical thermal maxima and responses to fluctuating thermal regimes indicate that adult rainbow, brown, and brook trout species introduced into the southwestern United States are as well adapted to elevated water temperature as adult Gila and Arizona trout, which are native to that region. (Journal abstract, adapted)

MAXIMUM SUSTAINABLE YIELDS IN SYSTEMS SUBJECT TO HARVESTING
AT MORE THAN ONE TROPHIC LEVEL

Beddington JR, May, RM. Mathematical Biosciences 51:3/4,
Oct 1980, 261-81.

Idealized mathematical models were used to study problems arising in the management of multispecies fisheries. Several situations are analyzed, all sharing the feature that species are harvested at two different levels in the food chain. The authors conclude that multispecies systems cannot be managed by piecemeal application of single-species "maximum sustainable yield" concepts. (Journal abstract, adapted)

HATCHERY TECHNIQUES: KEY TO THE GROWTH OF MARINE FISH FARMING

Jones A. Fish Farming International 7:3, Sep 1980, 13-14.

For marine fish farming to be profitable, hatchery-reared juveniles must be produced at reasonable cost. Adequate broodstocks and good holding facilities are the first requirement for any hatchery. Control of spawning time is now possible, ensuring the year-round availability of eggs and larvae. Diet and the main running costs of the hatchery are also explored in this article.

WATER QUALITY IN CATFISH PONDS

Boyd CE. Aquaculture 6:6, Sep/Oct 1980, 39.

Several studies conducted at Auburn University on managing water quality in catfish ponds are summarized briefly. Topics discussed include problems with low dissolved oxygen, aeration, use of chemicals, and the effect of the weather on catfish farming.

FISH FARM IN A FACTORY BASEMENT

Purves M. Fish Farming International 7:3, Sep 1980, 16-19.

A businessman in Copenhagen, Denmark, has invented a system of rotating biological filters which has enabled him to set up a fish farm in his basement. These filters purify the water and give a high oxygen content, which can support a dense fish population. Tap water is used as the fish growing medium and waste is disposed of through the city's sewage system. The implications of this for the aquaculture industry are important: fish from warm climates can be raised anywhere; warm and cold species can be raised on the same farm; and incoming water need not have adequate oxygen content.

PRACTICAL TRAINING IN AQUACULTURE

Aldridge CH. Fish Farming International 7:3, Sep 1980, 27-30.

In Scotland, where fishing is a major industry and over-exploitation of several species has occurred, the turn to aquaculture has been a natural one. In 1977 the Highland and Islands Board introduced a one-year course in the subject at the Inverness Technical College, and is now planning a series of short courses for workers already in the industry. The backbone of these programs is practical training in fish and shellfish farming techniques, taught at farm sites and in the college's own hatchery.

SURVIVAL, GROWTH, AND FOOD HABITS OF BROOK TROUT AND F₁ SPLAKE
PLANTED IN PRECAMBRIAN SHIELD LAKES

Fraser JM. Transactions of the American Fisheries Society
109:5, Sep 1980, 491-501.

The performance of planted brook trout and F₁ splake were studied in precambrian shield lakes. Splake survived better in three of the four lakes studied and the fourth lake showed a mean recovery rate of 28 percent for both splake and brook trout. Rate of growth and diet of both species were also examined. (Journal abstract, adapted)

FISH HARVEST RESULTING FROM MECHANICAL CONTROL OF HYDRILLA
Haller, W.T., Shireman, J.V., and DuPont, D.F. Transactions of the American Fisheries Society 109:5, Sep 1980, 517-20.

Mechanical harvesting of the submerged weed Hydrilla in Orange Lake, Florida, entangled fish in the cut vegetation, resulting in their disposal with the weeds on shore. Fish most susceptible to this harvesting were juvenile sportfish and smaller species. The monetary replacement value of the fish lost was estimated at over \$6,000/hectare. (Journal abstract, adapted)

WATER MOVEMENT FOR WATER QUALITY IN CATFISH PRODUCTION
Busch CD, Flood, CA. Transactions of the American Society of Agricultural Engineers Jul/Aug 1980, 1040-42.

In comparison to the photosynthetic oxygen supply, the maintenance of pond water quality through mechanical means is of limited value. Aerators remove, rather than supply, oxygen from water that is supersaturated. Mechanical stirring for the purpose of mixing surface and lower-level pond water offers some potential for complementing the photosynthetic oxygen supply. (Journal abstract, adapted)

SIX TONS OF CATFISH PER ACRE WITH CONSTANT AERATION
Plemmons B, Avault JW. Louisiana Agriculture 23:4, Summer 1980, 6-7.

In a study conducted by Louisiana State University's School of Forestry and Wildlife Management, high stock rates and constant aeration produced 6 tons of fish per acre. This figure approaches the maximum attainable with the type of aerators used in this study. With careful management, aeration becomes economically feasible at high-density stocking rates and provides a means of increasing fish production.

EVALUATION OF HYBRID CATFISH FOR ALABAMA FEE-FISHING PONDS
Tave C, McGinty AS, Chappell JA, and Smitherman RO.
Highlights of Agriculture Research 27:2, 1980, 11.

Fee-fishing ponds which provide both a source of income and recreation would benefit from a program to increase the catch. One method of increasing catch is to breed a fast-growing, more catchable fish. A study conducted at Auburn University Agriculture Experiment Station suggests that catch in fee-fishing ponds can be improved by stocking channel blue hybrid catfish.

HELPING RARE NATIVE TROUT IN THE SOUTHWEST
Johnson P. Forestry Research West May 1980, 8-10.

The Arizona and the Gila trout are presently the subject of a study at the Forestry Services Laboratory at Arizona State University. The research is directed at determining the distribution and the habitat of these two unique species. This study suggests that there is promise for restoring healthy populations of native trout in the Southwest.

MANUAL OF SMALL-SCALE FISH CULTURE
Song A. FAO Fisheries Circular No. 727, Apr 1980, 18.

Reservoir fish culture is a new area of aquaculture. This manual, based mainly on information from China, defines reservoirs and their features. It describes the feeding, harvesting and managing of fish in reservoirs and suggests the impact that further development of this culture could have on mankind's supply of protein-rich food.

MAJOR EXPANSION FORECAST FOR FISH FARMING IN THE 1980s
Smith R. Feedstuffs Feb 1980, 47.

In a 250-page analysis, International Resource Development, Inc., of Norwalk, Connecticut, forecasts that dwindling supplies of wild fish, together with an increase in the demand for fish as a meat, will be responsible for commercial expansion and success in aquaculture. The report, "Aquaculture in the 1980s," includes a comprehensive history and survey of the current state of the art of aquaculture, a breakdown of aquaculture activities by country and species grown, and a detailed picture of the problems and promises of aquaculture.

USDA ROLE STRUCTURED WITH RELEASE OF AQUACULTURE PROGRAM FOR
THE 1980s

Headliners, Aquaculture 6:2, Jan/Feb 1980, 4-5.

USDA's five year plan includes setting up a baseline data survey, allocating research monies, strengthening aquaculture extension services, and generally assuring the safety and quality of fish and the products entering the market from the aquaculture industry. This plan was developed by an Aquaculture Work Group chaired by Bille Hougart.

CATFISH FARMING WITH CHINESE CARPS

Newton SH. Arkansas Farm Research 29:1, Jan/Feb 1980, 8.

A 12-month pilot experiment was conducted at the University of Arkansas with channel catfish in polyculture with grass carp, silver carp, bighead carp and bigmouth buffalo. The culture method was intended to be semi-intensive to reduce production costs. Production of each species was measured. Complementary studies have supported the combined culture of these three Chinese carps and bass with catfish under typical fish-farming conditions. The authors believe low-density polyculture is less risky and more economical than high-density monoculture, especially for small and beginning farmers.

TROUT FARMING MANUAL

Stevenson JP. Farnham, Surrey, England: Fishing New Books Limited, 1980.

This book has been written to provide information necessary to set up a fish farm, run it smoothly, and turn it into a successful enterprise. Topics discussed include general farm practice, marine culture, hatchery installation and practice, broodstock and stripping, biology, and disease. Illustrations and a glossary are included.

Selected Periodicals

This section lists selected periodicals that include aquaculture within their scope. They are all in the National Agricultural Library, Beltsville, MD 20705 (telephone 301-344-3755).

AQUACULTURE

610 East Sixth, Little Rock, AR 72202 (bimonthly)

This publication includes news and feature articles of interest to those engaged in the production, processing, and marketing of finfish, shellfish, crustaceans, and aquatic plants. It includes reports of aquacultural operations, research summaries, and notices of legislative and commercial developments.

AQUACULTURE DIGEST

9434 Kearny Mesa Road, San Diego, CA 92126 (monthly)

A guide to fish and shellfish farming in the United States, this journal contains reviews and summaries of aquaculture articles. Special emphasis is given to business news, scientific research, and production for human consumption.

FARM POND HARVEST

Professional Sportsman's Publishing Company, Box AA, Momence, IL 60954
(four times a year: January, April, July, October)

Farm pond planning, construction and management, and fishing and harvesting are the topics addressed in this publication.

FISHERIES

American Fisheries Society, 5410 Grosvenor Lane, Bethesda, MD 20814
(bimonthly; available only to members)

This magazine features papers on fisheries management, announcements of recent fisheries developments, news and notes of American Fisheries Society's activities, and advertisements of interest to fisheries biologists.

FISHERIES TECHNICAL PAPERS

Food and Agriculture Organization of the United Nations, United Nations Publications, 345 Park Avenue South, New York, NY 10010 (periodic)

This series provides technical papers on all aspects of fish, fisheries research, management, techniques, conservation, and development.

FISHERY AND WILDLIFE RESEARCH

Division of Research, U.S. Fish and Wildlife Service, Washington, DC 20240
(annual)

This publication, which is the division's annual report, covers actions taken by the agency during the previous year.

FISHERY BULLETIN

National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Department of Commerce, 6010 Executive Boulevard, Rockville, MD 20852 (quarterly)

This journal carries original research reports and technical notes on investigations in fishing sciences, engineering, and economics.

JOURNAL OF FISH BIOLOGY

The Fisheries Society of the British Isles, 24/28 Oval Road, London, NW1 7DX, England (monthly)

This periodical includes articles and technical notes on all aspects of fish biology and fisheries research and management, including conservation.

LIMNOLOGY AND OCEANOGRAPHY

American Society of Limnology and Oceanography, 1530 12th Avenue, Grafton, WI 53024 (monthly)

This periodical contains original research papers in all aspects of limnology and oceanography.

NORTH AMERICAN JOURNAL OF FISHERIES MANAGEMENT

American Fisheries Society, 5410 Grosvenor Lane, Bethesda, MD 20814 (quarterly; available only to members)

This journal examines fisheries management techniques, describes management problems, issues and opportunities, and publicizes pertinent field notes and observations.

SALMONID

United States Trout Farmers Association, P.O. Box 171, Lake Ozark, MO 65049 (bimonthly)

This journal promotes the trout industry and recreational trout fishing in the United States by providing a forum for discussion of issues and for exchange of information on trout fishing techniques.

TRANSACTIONS OF THE AMERICAN FISHERIES SOCIETY

American Fisheries Society, 5410 Grosvenor Lane, Bethesda, MD 20814 (bimonthly; available only to members)

This publication is devoted to original research on fisheries biology and on the management of fish, fisheries, and related aquatic resources. It contains articles, brief communications, book reviews, and, occasionally, special sections exploring a single topic in depth.

Legislative Review

Recognizing the slow growth of aquaculture in the United States, the Federal Government has been examining methods to boost the industry. Congress has responded with the passage of the National Aquaculture Act of 1980 (P.L. 96-362), providing financial support for basic research on large-scale cultivation of fish and other water species. Below is a chronology of congressional efforts to assess the aquaculture industry and provide effective program support. For further information, contact the U.S. Department of Agriculture Law Library, Room 1406, South Building, Washington, DC 20250. The telephone number is (202) 447-7751.

95th Congress

President Carter used his first pocket veto (withholding his disapproval until after the congressional adjournment) to kill a bill (H.R. 9370) that would have provided Federal assistance for aquaculture. In his Oct. 18, 1978, veto message to Congress, the President expressed reservations about provisions that gave the aquaculture industry up to \$300 million in guaranteed Federal loans and up to \$250 million in insurance. "I am concerned about offering major new government subsidies...unless and until a clear need for them has been established," Carter explained. He said that many Federal departments and agencies were already involved in a wide variety of aquaculture activities, including research, and technical and financial assistance to the industry. As cleared by Congress on Oct. 2, 1978, the measure would have established a Federal Aquaculture Assistance Fund to provide financial assistance and support to the aquaculture industry. The bill also would have established a National Aquaculture Council--composed of the secretaries of Interior, Agriculture and Commerce--to assess the state of aquaculture in the United States and to prepare a National Aquaculture Development Plan, a detailed set of Federal activities to expand the commercial potential of certain aquatic species. Creation of an interagency Aquaculture Coordinating Committee, consisting of council members and the heads of six other Federal agencies with functions relating to aquaculture, would have improved the exchange of information and coordination among Federal agencies.

96th Congress

"The National Aquaculture Act of 1980," providing for \$70 million over a three-year period for aquaculture demonstration projects, was signed by President Carter on Sept. 16, 1980. The measure (P.L. 96-362) was similar to H.R. 9370,

passed by Congress in 1978 but vetoed by the president because of Federal loan guarantee provisions. The bill also directs the Departments of Agriculture, Commerce, and Interior to develop within 18 months a national plan for identifying fish species with a potential for commercial cultivation. An interagency advisory group, composed of the heads of the 13 Federal agencies with aquaculture responsibilities, was established and charged with preparing biennial reports on capital requirements for aquaculture development, and legal or regulatory constraints to development of the industry.

97th Congress

A new aquaculture research and extension program is included in the "Food and Agriculture Act of 1981" (H.R. 3603). The measure, introduced by House Agriculture Committee Chairman E. (Kika) de la Garza (D-TX), would provide grants to colleges and universities, Federal laboratories, and experimental stations to encourage and improve productivity in aquaculture. The bill would provide the Agriculture Department with an annual authorization of \$7.5 million through fiscal year 1985, and establish an advisory board to assist in conducting the program. Any projects, however, must be coordinated with the plan developed under the National Aquaculture Act of 1980. The bill was reported by the Agriculture Committee on May 19 (H. Rept. 97-106) and is awaiting floor action.

Rep. William C. Wampler (R-VA), ranking minority member of the Agriculture Committee, has introduced two bills (H.R. 23, H.R. 2561) to revise and extend the "Agriculture Research, Extension and Teaching Policy Act of 1977" (P.L. 95-113). The bills would establish a new "Subtitle L - Aquaculture" with provisions similar to those of the de la Garza measure. Both bills are pending in the Agriculture Subcommittee on Department Operations, Research, and Foreign Agriculture.

A bill (H.R. 2773) requesting jurisdictional transfer of the Fish Farming Experimental Station in Stuttgart, AR, from the Interior Department to the Agriculture Department was introduced on March 23 by Rep. Ed Bethune (R-AR). The transfer of the station, located in Bethune's Congressional District, would not require any new funding. The legislation was referred to the Merchant Marine and Fisheries Subcommittee on Fisheries and Wildlife Conservation and the Environment. There has been no action.

Current Research

This section is designed to keep our readers abreast of research sponsored or conducted by the USDA research agencies, the State Agricultural Experiment Stations, and other cooperating State institutions. The information listed here is taken from the Current Research Information System (CRIS), a computer-based information storage and retrieval system which serves as the USDA/State documentation and reporting system for publicly supported agricultural and forestry research in the United States.

CRIS provides retrieval services in response to requests for project information on the research documented in the system. CRIS in-house services are available primarily to research scientists, managers, and research administrators of USDA and participating State institutions. Access to this information is also available through the CRIS file or the Smithsonian Science Information Exchange (SSIE) data base via the DIALOG Information Systems online service.

Users in CRIS-participating institutions should submit requests on Form AD-427. Requests should be sent to Current Research Information Systems, USDA, NAL Building, Beltsville, MD 20705 (telephone 301-344-3850).

The 25 projects listed here are investigations of practical aspects of commercial freshwater aquaculture. Topics studied are the selection of species and combinations thereof; feeding and harvesting; disease control; and the economics of the catfish-for-food industry. Research is underway at universities and experiment stations throughout the country, but especially intensive efforts are being made in the Southeast--in Alabama, Arkansas, Louisiana, and Mississippi.

Analysis of the
Market Potential
for Fresh Water
Aquacultural Pro-
ducts Produced
in Nevada

PURPOSE: To determine the cost and availability of byproduct food stuffs for feeding catfish and shrimp in Nevada, and to estimate the demand for catfish, shrimp and plants produced in fresh warm water ponds. Marketing margins for fresh water products and an estimate for marketing constraints placed on fresh water products by the institutional trade will also be studied.

GRANT NO./FUNDING SOURCE: NEV 00270/HATCH
PERFORMER: Agriculture and Resource Economics, University of Nevada, Reno, Nevada
INVESTIGATORS: J.R. Garrett, B.L. Taylor
PERIOD: 1 July 1977 to 30 September 1980
PROGRESS: Preliminary analysis of 10 one-acre plots suggests that "live whole" and "fresh whole" appear to be the most viable alternatives for marketing Malaysian prawns in Nevada. Even a small-scale processing plant to process "tails only" is too great an investment based on the yields assumed in the study.

Breeding, Production, Nutrition and Marketing of Channel Catfish

PURPOSE: To obtain quantitative data on the growth rate of selected strains of channel catfish and the reaction of selected strains to different dietary formulations, as well as to identify interaction of growth rates, diets and pond water quality degradation. Also, to develop methods for product storage and flavor quality.

GRANT NO./FUNDING SOURCE: KAN 00962/STATE
PERFORMER: Department of Biology, Kansas State University, Manhattan, Kansas
INVESTIGATORS: J.R. Kelley, Jr., C. Deyoe, H. Klaassen
PERIOD: 1 September 1975 to 30 June 1980
PROGRESS: Ponds were stocked with catfish fry at a rate of 50,000 per acre. No significant differences were found between survival and growth of fish in ponds treated with different levels of cobalt chloride and an untreated pond. Mean survival for channel catfish in all ponds was 22 percent (range 20 to 28 percent) and mean individual weight was 6.2 grams (range 5 to 7 grams).

Catfish Breeding, Production, and Marketing

PURPOSE: To develop processing and marketing technology for the catfish industry.

GRANT NO./FUNDING SOURCE: ARK 00763/HATCH
PERFORMER: Agricultural Economics and Rural Sociology, University of Arkansas, Fayetteville, Arkansas
INVESTIGATOR: W.R. Morrison
PERIOD: 1 July 1971 to 30 September 1981
PROGRESS: Interviews with buyers and controlled in-store interviews with customers were used to collect data on preference, usage and buying practices to provide the basis for evaluating the market potential for catfish products.

Channel Catfish Nutrition

PURPOSE: To determine the dietary requirements and interaction for each of the essential amino acids in channel catfish. Additionally, to investigate their digestion, absorption, and metabolism of proteins, amino acids and carbohydrates.

GRANT NO./FUNDING SOURCE: MIS 0818/HATCH

PERFORMER: Department of Biochemistry, Mississippi State University, Mississippi State, Mississippi

INVESTIGATOR: R.P. Wilson

PERIOD: 1 October 1976 to 30 September 1980

PROGRESS: Amino acid studies with channel catfish have shown that tyrosine can supply approximately 50 percent of the total amino acid requirement. Excessive levels of dietary tyrosine (up to 10 percent) were shown not to be detrimental to the general performance of the catfish. Requirements and limits for phenylalanine and leucine were also determined. Investigation of the methodology of conducting amino acid digestibility trials with channel catfish indicated that the dissection method of fecal collection is more reliable than collection by sedimentation.

Channel Catfish Nutrition

PURPOSE: To determine the protein digestibility and amino acid availability of various foodstuffs for channel catfish and to test these in least-cost rations. Additionally to test various foodstuffs for potential antinutritional factors, to determine mineral requirements, and to investigate various biochemical or metabolic parameters in the catfish.

GRANT NO./FUNDING SOURCE: MIS 0844/HATCH

PERFORMER: Department of Biochemistry, Mississippi State University, Mississippi State, Mississippi

INVESTIGATOR: R.P. Wilson

PERIOD: 1 October 1980 to 30 September 1985

PROGRESS: Growth and digestive enzyme studies are being conducted in catfish to assess the potential of antinutritional factors in various feed ingredients. Mineral requirements studies will be conducted utilizing the same or similar experimental design that was previously used to determine the amino acid requirements.

Culture Systems for Year-Round Marketing of Fish From Water- shed Ponds

PURPOSE: To develop techniques for year-round production, harvesting, and marketing of aquacultural crops from watershed ponds.

GRANT NO./FUNDING SOURCE: ALA 00496/HATCH

PERFORMER: Fisheries and Allied Aquaculture, Auburn University, Auburn, Alabama

INVESTIGATORS: R.O. Smitherman, E.W. McCoy

PERIOD: 1 April 1979 to 30 September 1983

PROGRESS: Channel catfish, tilapia, silver carp, and rainbow trout are being produced in watershed ponds, and harvested periodically with cages, drop nets and corral seines to extend the marketing season and to improve cash flow. Substantial yields have been realized, and marketing has been extended throughout 12 months. Survival has been estimated at was 90 percent.

Develop and Improve
Production and
Management Systems
for Freshwater
Animals Cultured
for Food

PURPOSE: To select and evaluate fish species combinations (polyculture) with potential for adaptation to farm ponds; to introduce hybrids and new species to the ponds; to evaluate various environmental situations and management techniques; and to develop basic techniques of providing fish culture information to low-income farmers as well as to large commercial fish producers.

GRANT NO./FUNDING SOURCE: AR. X-PR-006-902/GRANT

PERFORMER: Agriculture, University of Arkansas, Pine Bluff, Arkansas

INVESTIGATORS: S.H. Newton, C.J. Haskins, W.R. Robison

PERIOD: 1 April 1977 to 31 March 1982

PROGRESS: A pond sampling midway in a two-year polycultural production study indicated that catfish sizes were similar in polyculture and monoculture situations. Grass carp showed a 200 percent increase in growth rate; the bigmouth buffalo is suggested for combination with channel catfish and grass carp. Largemouth bass are an effective predator for control of wild fishes.

Digestibility of
High Energy and
High Protein Feed-
stuffs for Channel
Catfish

PURPOSE: To determine, for channel catfish, the digestible energy and digestible crude protein of soybean meal, peanut meal, corn gluten meal, fish meal, tankage, blood meal, and poultry byproduct meal as well as the digestible energy of corn oil, safflower oil, coconut oil, poultry oil, tallow, lard, and margarine.

GRANT NO./FUNDING SOURCE: TENN 1-2-058-0

PERFORMER: Department of Forestry, Wildlife, and Fisheries, Agricultural Experiment Station, University of Tennessee, Knoxville, Tennessee

INVESTIGATORS: R.J. Strange, K.R. Robbins, J.L. Wilson

PERIOD: 1 September 1981 to 31 August 1983

APPROACH: Digestible energy will be determined by feeding catfish an energy-deficient, protein-adequate diet containing cellulose and chromic oxide. Half the fish will receive the experimental diet and half the same diet in which some of the cellulose has been replaced with the feedstuff to be tested. Fecal samples will be analyzed for combustible energy and chromic oxide; digestible energy will then be calculated. Digestible crude protein will be determined by feeding catfish an otherwise nitrogen-free diet containing an individual feedstuff and chromic oxide indicator. Fecal samples will be analyzed for crude protein and chromic oxide; digestible crude protein will then be calculated.

Disease Management
in Catfish Aqua-
culture

PURPOSE: To identify early warning indicators of environmental stress; to identify factors associated with host susceptibility and pathology of bacterial hemorrhagic septicemia in cultured catfish; and to develop and evaluate countermeasures for reducing the incidence of bacterial hemorrhage septicemia in cultured catfish.

GRANT NO./FUNDING SOURCE: TEX 06421/GRANT
PERFORMER: Veterinary Microbiology, Texas A&M University,
College Station, Texas
INVESTIGATOR: D.H. Lewis
PERIOD: 4 June 1979 to 30 September 1982
PROGRESS: Fish are being exposed to conditions of temperature
and ammonia stress and monitored for alterations in blood
and tissue chemistry. They are being exposed to various
disease agents under conditions of stress and monitored to
determine susceptibility and immunocompetence. Efforts to
immunize young catfish by osmotic infiltration have thus far
been unsuccessful.

Effects of Environ-
mental Temperature
on Protective
Immunity in
Channel Catfish

PURPOSE: To determine the effects of environmental tempera-
ture on longevity and stability of humoral immunity in channel
catfish, on protective immunity in vaccinated channel catfish,
and on opsonization ability of sera from immunized channel
catfish.

GRANT NO./FUNDING SOURCE: AL 27-0009
PERFORMER: Department of Fisheries and Allied Aquacultures,
Auburn University, Auburn, Alabama
INVESTIGATOR: J.A. Plumb
PERIOD: 1 August 1981 to 31 January 1983
APPROACH: Channel catfish will be vaccinated with Edward-
siella sp., held at 30°C for 30 days and then acclimated to
various temperatures from 5°C to 35°C. Fish will be bled
periodically and the longevity of the humoral antibody re-
sponse and cell-mediated immunity determined. Protective
immunity will be determined through experimental quantitative
challenge on subsamples of fish, held at various temperatures,
at 30, 60, and 90 days post vaccination.

Evaluation of By-
Products from Cat-
fish Processing
Waste for Catfish
Feed Supplements

PURPOSE: To evaluate nutritional value for channel catfish
fingerlings of concentrated protein, bone meal and oil by-
products made from catfish processing waste; and to recommend
practical catfish feed formulations based on optimum use of
these by-products.

GRANT NO./FUNDING SOURCE: 7003-20530-004-A/Cooperative
Agreement with USDA's Science and Education Administration
PERFORMER: Biochemistry, Mississippi State University,
Mississippi State, Mississippi
INVESTIGATORS: R.P. Wilson, D.W. Freeman
PERIOD: 7 September 1979 to 30 September 1981
PROGRESS: The following by-products might be feasible for
testing in aquaria studies: dried meal made by traditional
rendering, dried meal made by the silage process with bones,
dried meal made by silage process without bones, dried meal
made from bones only, and commercially available fish meal.

Factors Influencing
Trout Production
in Virginia Streams

PURPOSE: To examine links between the food production base and brook trout production, to study brook trout competition with other trout and with non-game fish, and to determine rainbow trout production and gonadal energetics.
GRANT NO./FUNDING SOURCE: VA 1111114/STATE
PERFORMER: Fisheries and Wildlife, Virginia Polytechnic Institute, Blacksburg, Virginia
INVESTIGATORS: G.B. Pardue, E.F. Benfield, J.R. Webster
PERIOD: 1 July 1980 to 30 June 1983
PROGRESS: Investigators are collecting monthly quantitative samples of macroinvertebrates to determine trophic structure, biomass, production and feeding rates; as well as to collect quarterly depletion samples of fishes to determine trophic structure, biomass, production and food habits. Food habits of trout are being compared with those of nongame fishes.

Freshwater Food
Animals

PURPOSE: To develop and improve production and management systems for freshwater animals cultured for food, and to evaluate the economics of production, processing and marketing of freshwater food animals.
GRANT NO./FUNDING SOURCE: GE 000283/HATCH
PERFORMER: Entomology-Fisheries, Georgia Coastal Plain Experiment Station, Tifton, Georgia
INVESTIGATORS: T.K. Hill, E.E. Brown, J.L. Chesness
PERIOD: 1 October 1976 to 30 September 1981
PROGRESS: Diets for channel catfish and rainbow trout were tested in raceways. Water quality was monitored and waste removal investigated. Results showed that water temperatures under 4°C for 20 or more days reduced trout production significantly, while multiple harvesting of catfish resulted in higher net production of fish per raceway segment. Also, feed conversion ratios were higher for catfish fed a sinking feed than for those fed a floating feed.

Freshwater Food
Animals

PURPOSE: To develop a production and management system for freshwater animals cultured for food; to evaluate the economics of production, processing and marketing of fresh water food animals, and to develop and improve products and processing methods that will enhance marketability and insure quality of cultured freshwater food animals.
GRANT NO./FUNDING SOURCE: MIS 0819/HATCH
PERFORMER: Wildlife and Fisheries Science, Mississippi State University, Mississippi State, Mississippi
INVESTIGATORS: R.E. Reagen, H.R. Robinette, R.P. Wilson
PERIOD: 1 October 1976 to 30 September 1981
PROGRESS: Least cost rations are being tested on channel catfish. Genetic parameters are being correlated with various traits in a selection program. Amino acid requirements and digestibility of common feedstuffs are being determined, and fish processing methods compared for dress-out yield. Standard nutritional values of catfish flesh are being determined.

Freshwater Food
Animals

PURPOSE: To develop production and management systems for freshwater animals cultured for food.
GRANT NO./FUNDING SOURCE: TEN 00491/HATCH
PERFORMER: Forestry and Wildlife, University of Tennessee, Knoxville, Tennessee
INVESTIGATOR: J.L. Wilson
PERIOD: 1 October 1976 to 30 September 1981
PROGRESS: A comparison was made of production in polyculture (catfish and tilapia) and monoculture systems (catfish only). An effort was also made to determine which stocking ratio of tilapia to channel catfish results in the highest production, and what density of tilapia utilizes organic wastes of catfish most efficiently.

Improvement of
Catfish Stock
Through Selective
Breeding

PURPOSE: To improve catfish stock by selective breeding for fast growth, high dressing percentage, and other desirable traits.
GRANT NO./FUNDING SOURCE: LAB 01524/STATE
PERFORMER: Forestry and Wildlife Management, Louisiana State University, Baton Rouge, Louisiana
INVESTIGATOR: J.W. Avault, Jr.
PERIOD: 1 January 1970 to 30 September 1981
PROGRESS: Five spawns of channel catfish were collected for each of four populations from diverse areas of southeastern United States. All possible crosses were made among the populations, with the idea of developing inbred lines for crossing. Six families of catfish were compared in the laboratory for their ability to withstand low levels of dissolved oxygen. Most deaths occurred within 8 hours of the tests. Preliminary data indicate distinct differences in low dissolved oxygen tolerance among families. This knowledge may be useful as a tool in selecting genetically superior fish for farming.

Intensive Culture
of Crayfish

PURPOSE: To develop an intensive culture method for crayfish suitable for use in northeastern U.S.; and to evaluate growth, mortality and time of sexual maturity in order to assess the feasibility of intensive culture of crayfish.
GRANT NO./FUNDING SOURCE: NYC 147432/HATCH
PERFORMER: Natural Resources, Cornell University, Ithaca, New York
INVESTIGATOR: W.D. Youngs
PERIOD: 28 August 1980 to 30 September 1983
APPROACH: A modular unit will be designed which will isolate individual crayfish, allow re-use of water and occupy minimal space. Growth will be measured by weekly weighing of individual crayfish; mortality will be determined weekly. Feasibility will be determined on the basis of potential economic value, taking into consideration the growth and mortality of the crayfish and the cost of building and operating a culture system.

Market Potential
and Current
Marketing Pro-
cedures and
Practices of
the Catfish for
Food Industry

PURPOSE: To determine and describe the structural and operational characteristics and the procurement and marketing practices of the U.S. catfish industry, as well as the characteristics of food brokers, wholesalers, distributors, and chain grocery firms handling catfish food products.
GRANT NO./FUNDING SOURCE: MIS 0841/STATE
PERFORMER: Agricultural Economics, Mississippi State University, Mississippi State, Mississippi
INVESTIGATORS: J.R. Conner, J.E. Waldrop
PERIOD: 1 July 1979 to 30 June 1981
PROGRESS: Interviews were to be conducted with marketing and management personnel from processing food broker, wholesaler, distributor and chain grocery firms handling catfish for food, and with a representative sample of retail firms handling domestically produced catfish for food. Volumes of domestically produced catfish sold from the sample stores were to be used to estimate potential volume that could be sold in the current market area.

Natural Production
of Trout in
Infertile
Mountain Streams
of Pennsylvania

PURPOSE: To determine factors which limit natural reproduction and growth of trout in infertile streams; to develop methods of manipulating the limiting factors.
GRANT NO./FUNDING SOURCE: PEN 02408/STATE
PERFORMER: Fisheries and Wildlife, Pennsylvania State University, University Park, Pennsylvania
INVESTIGATOR: D.E. Arnold
PERIOD: 1 May 1979 to 30 June 1983
PROGRESS: Fertile and infertile streams were compared with regard to number and size of fish produced, effects of rainfall chemistry, and other factors. Collection of water samples and fish for study of mineral nutrition sufficiency in acidic, infertile streams has been completed, and laboratory analysis is in progress.

Off-Flavor in
Pond-Raised
Catfish

PURPOSE: To characterize the biochemical nature of off-flavor in pond-raised catfish, and to identify organisms and pond conditions associated with off-flavor catfish.
GRANT NO./FUNDING SOURCE: AL 27-0008
PERFORMER: Fisheries and Allied Aquacultures, Auburn University, Auburn, Alabama
INVESTIGATOR: R.T. Lovell
PERIOD: 1 July 1981 to 30 June 1983
APPROACH: The investigator will collect off-flavor catfish from ponds or processing plants, sensorily identify the off-flavors, and extract and chemically identify the compounds. Commercial ponds in various geographic areas and under various management conditions will be monitored for water chemistry and biology and incidence of off-flavor, over two growing seasons. An effort will be made to identify the conditions responsible for off-flavor in catfish.

Recovery and Con-
version of Catfish
Processing Waste
Into Valuable
Feed Supplements

PURPOSE: To assess, modify and/or develop methods to recover processing waste from catfish farmers/processors and to turn it into valuable and nutritious feed supplements. To characterize and evaluate feed supplements and to assess the energy and equipment requirements of processing.

GRANT NO./FUNDING SOURCE: 7102-20532-001/INHOUSE

PERFORMER: Southern Regional Research Center, ARS/USDA
New Orleans, Louisiana

INVESTIGATOR: D. Freeman

PERIOD: 29 August 1979 to 29 August 1981

PROGRESS: Catfish waste (heads, viscera and skin) were evaluated in laboratory tests, using a process appropriate for commercially conversion of waste to oil and feed supplements. It was determined that fat from viscera could be rendered by heating and centrifuging; chopped or ground waste could be converted to fish silage by heating, then separated into bones, oil, and de-oiled silage. Silage samples were reduced to a viscous concentrate by evaporation; high-protein fish meal was then prepared by drying and grinding the concentrate.

Rainbow Trout
Breeding and
Selection

PURPOSE: To define or develop breeding and selection methods for rainbow trout; to characterize genetically the strains, lines, and hybrids developed; and to evaluate their suitability for a variety of uses and environments.

GRANT NO./FUNDING SOURCE: 86420-963-71

PERFORMER: Fish and Wildlife Service, U.S. Department of the Interior, Beulah, Wyoming

INVESTIGATORS: H.L. Kincaid, E.A. Pyle, J.L. Brauhn

PERIOD: Ongoing

PROGRESS: Activities include definition of breeding techniques and numbers of fish necessary for maintaining genetic characteristics; determination of the effects of inbreeding and crossbreeding on performance in laboratory, hatchery, and field environments; and evaluation of selection techniques.

Survey of Diseases
of Cultured Fresh-
water Fishes of
California

PURPOSE: To identify and catalog the infectious diseases which hinder freshwater aquaculture in California; to describe conditions associated with the epizootics; and to develop techniques of minimizing losses due to disease.

GRANT NO./FUNDING SOURCE: CA-D-ASC-3732-AH/ANIMAL HEALTH

PERFORMER: Animal Science, University of California,
Davis, California

INVESTIGATOR: P.R. Bowser

PERIOD: 10 March 1979 to 30 September 1983

PROGRESS: To date the survey has indicated that California aquaculturists have experienced the same diseases found in other areas of the United States. Diseases have been diagnosed in channel catfish, rainbow trout, and other fish. The most

common problems were those caused by facultative bacterial pathogens. Parasitic protozoans were also found. One finding of special interest was that several of the bacterial isolates showed resistance to some of the more commonly utilized antibiotics.

Urban Aquaculture
of the Rainbow
Trout (*Salmo*
Gairdneri)

PURPOSE: To determine if aquaria-raised trout can be raised to a marketable size in environmentally controlled, refrigerated aquaria in a shorter period of time and with less expense than with traditional outdoor methods employed by fish farmers.
GRANT NO./FUNDING SOURCE: A-007-DC
PERFORMER: College of Life Sciences, University of the District of Columbia (Van Ness Campus), Washington, DC
INVESTIGATOR: A.J. Jones
PERIOD: 1 June 1980 to 30 July 1981
PROGRESS: Fish are raised at different temperatures to determine the best temperatures for optimum and maximum growth rates. Length and weight measurements are constantly monitored. Data will be analyzed to determine the combinations of parameters for growth, and these conditions will be duplicated in Phase II of this research.

Water Quality
Control in Fresh-
water Prawn Ponds

PURPOSE: To investigate the use of fishes and aquatic plants in fresh water prawn ponds in order to conserve water, allow for more efficient use of nutrients in applied feeds, and improve the quality of discharged water; to assess the major biological and chemical indices of water quality in experimental ponds, in order to best evaluate the impact of treatments.
GRANT NO./FUNDING SOURCE: HAW 222-050-457
PERFORMER: Department of Oceanography, University of Hawaii, Honolulu, Hawaii
INVESTIGATOR: E.A. Laws
PERIOD: 1 September 1981 to 31 August 1983
APPROACH: Characteristics to be assessed will include water column biomass and production, benthic microbial biomass and production, and benthic meiofauna biomass and the factors limiting production. Treatments will include introduction of grass and/or silver carp, water hyacinths and/or duckweeds. Phytoplankton growth limitation will be studied using light assimilation numbers and alkaline phosphatase activity.

Selected Information Sources

This section lists private organizations, citizens' groups, Federal government agencies, and congressional committees who have addressed the issue of aquaculture.

Non-Governmental

American Catfish Marketing Association
P.O. Box 1609
Jackson, MS 39205
Acting Executive Secretary:
James H. Smith
(601) 948-5938

American Fish Farmers Federation
P.O. Box 158
Lonoke, AR 72086
President: Jim Maloney
(501) 676-2800

American Fisheries Society
5410 Grosvenor Lane
Bethesda, MD 20014
Executive Director: Carl R. Sullivan
(301) 897-8616

American Salmon Growers Association
6427 So. Island Drive
Summer, WA 98390
President: Greg Ferguson
(206) 863-5537

Bass Research Foundation
P.O. Box 99
Starkville, MS 39759
Executive Director: Walter Stubbe
(601) 323-3131

Catfish Farmers of America
P.O. Box 34
Jackson, MS 39205
Executive Secretary: Mark Freeman
(601) 353-7916

Inland Commercial Fisheries Association
Box 2565
Oshkosh, WI 54903
Executive Director: Virgil Young
(414) 424-3057

Fish Culture Section of the American
Fisheries Society
P.O. Box 4004
Monroe, LA 71203
President: Janice S. Hughes
(318) 343-4044

New England Collaborative For Aquaculture
240 Alden Road
Fairhaven, MA 02719
President: Frank Baker

Pacific Oyster Growers Association
270 South Hanford Street
Seattle, WA 98134
President: David McMillin
(206) 625-1481

Shellfish Institute of North America
400 North Capitol Street, Suite 323
Washington, DC 20001
Executive Director: R. Josh Lanier
(202) 783-2803

Southern Southeast Regional Aquaculture
Association, Inc.
P.O. Box 6916
Ketchikan, AK 99901
Executive Director: Ronald W. Wendte
(907) 225-9605

U.S. Aquaculture Council and U.S.
Aquaculture Federation
P.O. Box 276
Lacey Springs, VA
Chairman: Fern Wood Mitchell
(703) 433-2395

United States Trout Farmers Association
P.O. Box 171
Lake Ozark, MO 65049
Executive Director: Tim Pilkington
(314) 365-2478

World Mariculture Society
174 Pleasant Hall, Division of
Continuing Education
Louisiana State University
Baton Rouge, LA 70803
President: Carl J. Sindermann

U.S. Government Agencies

Agency for International Development
Bureau of Science and Technology
Office of Agriculture
Washington, DC 20523
Contact: Kenneth Osborn
(703) 235-8993

Department of Agriculture
Agricultural Marketing Service
14th Street and Independence Avenue, SW
Washington, DC 20250
Contact: James Toomey
(202) 447-2704

Department of Agriculture
Aquaculture Work Group
14th Street and Independence Avenue, SW
Washington, DC 20250
Chairman: Bille Hougart
(202) 447-6504

Department of Agriculture
Animal and Plant Health Inspection
Service
14th Street and Independence Avenue, SW
Washington, DC 20250
Contact: Ralph Hosker
(202) 436-8715

Department of Agriculture
Cooperative State Research Service
Animal Science
14th Street and Independence Avenue, SW
Washington, DC 20250
Contact: Clyde Richards
(202) 447-6628

Department of Agriculture
Economic Research Service
GHI Building
500 12th Street, SW
Washington, DC 20250
Contact: Michael Stellmacher
(202) 447-8636

Department of Agriculture
Farmers Home Administration
Business and Industry Programs
14th Street and Independence Avenue, SW
Washington, DC 20250
Contact: Dean Moore
(202) 447-3479

Department of Agriculture
Farmers Home Administration
Farm Real Estate and Production
Loan Division
14th Street and Independence Avenue, SW
Washington, DC 20250
Contact: Lynn Pickinpaugh
(202) 447-4669

Department of Agriculture
Federal Crop Insurance Corporation
14th Street and Independence Avenue, SW
Washington, DC 20250
Contact: George Vohs
(202) 447-3287

Department of Agriculture
Food Safety and Quality Service
14th Street and Independence Avenue, SW
Washington, DC 20250
Administrator: Donald Houston
(202) 447-7025

Department of Agriculture
Rural Electrification Administration
14th Street and Independence Avenue, SW
Washington, DC 20250
Contact: Charles Crowley
(202) 382-8434

Department of Agriculture
Science and Education-Extension
14th Street and Independence Avenue, SW
Washington, DC 20250
Contact: Jim Miller
(202) 447-5468

Department of Agriculture
Soil Conservation Service
14th Street and Independence Avenue, SW
Washington, DC 20250
Contact: Carl H. Thomas
(202) 447-5991

Department of Agriculture
U.S. Forest Service
Wildlife Fisheries
P.O. Box 2417
Washington, DC 20013
Contact: Phillip Summers
(703) 235-8015

Department of Commerce
National Oceanic and Atmospheric
Administration
National Marine Fisheries Service
3300 Whitehaven Street, NW
Washington, DC 20235
Contact: Tapan Banerjee
(202) 634-7535

Department of Commerce
National Oceanic and Atmospheric
Administration
Research and Development
Office of Sea Grant
6010 Executive Boulevard
Rockville, MD 20852
Contact: Robert Wildman
(301) 443-8923

Department of Defense
Army Corps of Engineers
20 Massachusetts Avenue, NW
Washington, DC 20314
Contact: Melvin L. Martin
(202) 272-0257

Environmental Protection Agency
Office of Water Program Operations
401 M Street, SW
Washington, DC 20460
Contact: Robert Bastian
(202) 426-8976

Environmental Protection Agency
Office of Water Regulations and Standards
401 M Street, SW
Washington, DC 20460
Contact: Joseph A. Krivak
(202) 755-0100

Farm Credit Administration
490 L'Enfant Plaza East, SW
Washington, DC 20578
Contact: George Irwin
(202) 755-2134

Food and Drug Administration
Bureau of Foods
Division of Food Technology
200 C Street, NW
Washington, DC 20240
Contact: John P. Lucas
(202) 245-1557

Food and Drug Administration
Bureau of Drugs for Swine and Minor
Species
5600 Fishers Lane
Rockville, MD 20857
Contact: Nelson Chou
(301) 443-3410

Department of Interior
Bureau of Indian Affairs
Washington, DC 20240
Contact: Barry Betts
(202) 343-6574

Department of Interior
U.S. Fish and Wildlife Service
Division of Hatcheries and Fishery
Resource Management
Washington, DC 20240
Contact: Ken Allen
(202) 632-5166

Department of Interior
U.S. Fish and Wildlife Service
Division of Fishery Ecology Research
1717 H Street, NW
Washington, DC 20240
Contact: James Weaver
(202) 653-8772

Department of Interior
U.S. Fish and Wildlife Service
Office of Extension Education
Washington, DC 20240
Contact: Erland Juntunen
(202) 653-8787

Department of Interior
Office of Territorial and International
Affairs
Washington, DC 20240
Contact: Nora Uchida
(202) 343-6816

National Science Foundation
Biological Oceanography Program
1800 G Street, NW
Washington, DC 20550
Contact: Bob Carney
(202) 357-9600

National Science Foundation
Division of Environmental Biology
1800 G Street, NW
Washington, DC 20550
Contact: Josephine Daugherty
(202) 357-9734

National Science Foundation
Small Business Innovative Research
1800 G Street, NW
Washington, DC 20550
Contact: Richard Coryell
(202) 357-9848

Small Business Administration
1441 L Street, NW
Washington, DC 20416
Contact: Robert Clairmont
(202) 653-6081

Tennessee Valley Authority
Office of Natural Resources
Norris, TN 37828
Manager: Thomas H. Ripley
(615) 632-2418

U.S. Congress

House Agriculture Committee
1301 Longworth HOB
Washington, DC 20515
Chairman: Rep. E. "Kika" de la Garza
(D-TX)
(202) 225-2171

House Appropriations Committee
Subcommittee on Agriculture, Rural
Development and Related Agencies
2362 Rayburn HOB
Washington, DC 20515
Chairman: Rep. Jamie L. Whitten (D-MS)
(202) 225-2638

Senate Agriculture, Nutrition and
Forestry Committee
322 Russell SOB
Washington, DC 20510
Chairman: Sen. Jesse Helms (R-NC)
(202) 224-2035

Senate Appropriations Committee
Subcommittee on Agriculture and Related
Agencies
1320 Dirksen SOB
Washington, DC 20510
Chairman: Sen. Thad Cochran (R-MS)
(202) 224-7272

Calendar of Upcoming Events

This calendar lists 1982 public meetings, workshops, and seminars that might be of concern to our readers. The meetings listed are not sponsored or endorsed by the U.S. Department of Agriculture unless so specified. The calendar lists meetings as far in the future as possible. Please send us notices of events you would like to see included.

January 1982

17-19

Catfish Farmers of America 1982 Convention and Trade Show
Biloxi Hilton Hotel, Biloxi, MS
Contact: Mark Freeman, Executive Secretary
CFA
P.O. Box 34
Jackson, MS 39205 (601) 353-7916

February 28- March 4, 1982

World Mariculture Society Annual Conference
Sheraton Charleston, Charleston, SC
Contact: Department of Wildlife and Fisheries Sciences
Texas A&M University
College Station, TX 77843 (713) 845-6751

March 1982

26-31

North American Wildlife and Natural Resources Conference
Portland Hilton Hotel, Portland, OR
Contact: C.R. Jahn
Wildlife Management Institute
100 Vermont Avenue, NW
709 Wire Building
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